भारतीय मानक
Indian Standard

IS 17725 : 2022

पूर्वढलित कंक्रीट वृताकार मैनहोल — विशिष्टि

Precast Concrete Circular Manhole — Specification

ICS 93.020

© BIS 2022

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

July 2022 **Price Group 9**

Cement Matrix Products Sectional Committee, CED 53

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement Matrix Products Sectional Committee had been approved by the Civil Engineering Division Council.

Precast concrete manholes form one of the essential ancillary structures in any sewerage system and storm water drains. They are generally provided at every change of alignment or gradient of sewers at every junction of two or more sewers, at head of all sewers or branches, wherever there is a change in size of sewer and at regular intervals in the sewerage system. They are used for inspection, cleaning and repairing of sewers and other maintenance operations. The total cost of precast manhole may work out be as 30 to 40 percent of the total cost of sewerage system. This standard has been formulated with a view to giving guidance on proper design and construction of precast manholes and to provide uniformity in the variety of drainage practices followed by various municipal corporations, municipalities and other bodies in public and private sector in the country.

This standard covers the design considerations, construction, specifications, and methods of test for precast concrete circular manhole and its components.

The main advantages using precast concrete manhole, over brick masonry manhole and *in-situ* constructed manhole are as follows.

a) Units are factory produced, using vibration and pressure machines;
b) They can be manufactured in a wide range of standard sizes and depths;
c) They are simple to assemble, requiring relatively unskilled labourer on site;
d) Units are capable of being constructed as watertight structures;
e) They are normally supplied already fitted with steps or without steps as per the requirement;
f) The manholes are durable due to own inherent strength and being factory made products;
g) It can match to road level by adding or removing grade rings, even in case of future construction of roads; and
h) Speed of the manhole construction over the conventional manholes is higher by about 20 to 30 times.

The composition of the Committee responsible for the formulation of this standard is given in Annex G.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PRECAST CONCRETE CIRCULAR MANHOLE — SPECIFICATION

1 SCOPE

1.1 This standard covers the design considerations, construction, specifications and methods of test for precast concrete circular manhole components.

1.2 This standard does not cover requirements for manhole covers and frames, and the same are covered in IS 12592.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated in Annex A.

3 TERMINOLOGY

3.1 Access Shaft — The vertical passage to the manhole from the manhole opening.

3.2 Benching — Sloping surfaces having slope in transverse direction constructed on either side of channels at the base of manholes or inspection chamber for the purpose of confining the flow of sewage, avoiding the accumulation of deposits and providing a safe working platform.

3.3 Channel — The open waterway through which sewage, storm water or other liquid wastes flow at the invert of a manhole.

3.4 Depth of Manhole — The vertical distance from the top of the manhole cover to the outgoing invert of the main drain channel.

3.5 Invert — The lowest point of the interior of a sewer or drain at any cross section. In a manhole chamber, the lowest point of channel in the floor of the chamber which carries the flow of sewage through the manhole.

3.6 Manhole — An opening by which a man may enter or leave a drain, a sewer or other closed structure for inspection, cleaning and other maintenance operations, fitted with a suitable cover.

4 CIRCULAR PRECAST CONCRETE MANHOLES

4.1 Precast concrete circular manhole is straight in lower portion and narrows down at the top opening matching with internal diameter of precast manhole cover, using various components. The diameter of precast manhole depends upon the depth of manhole and the inlet and outlet pipe diameter. The change in diameter of base section with respect to depth and inlet and outlet pipe diameter is given in Table 1.

4.2 Components of Circular Precast Concrete Manhole

Circular precast concrete manhole is made up of components as given in **4.2.1** to **4.2.8**. Typical arrangement and component detail of precast concrete circular manhole is as given in Fig. 1. A rocker pipe (*see* **4.2.9**) may also be provided considering site conditions, as decided by the Engineer-in-charge.

4.2.1 *Base Unit*

The base unit may be manufactured monolithically with base slab (flush/projected) along with base riser or can be cast as separate individual unit as shown in the Fig. 2.

The base unit has several functions, such as:

a) to establish a solid foundation for the whole precast manhole system and the connecting pipes, and carry load of an eventual traffic;
b) to connect two, or more adjoining pipes, preferably with flexible joints, having the same specifications as the joints in the adjoining pipelines;
c) to provide easy access to the pipelines for inspection and cleaning; and
d) to divert the main pipeline direction, if required.

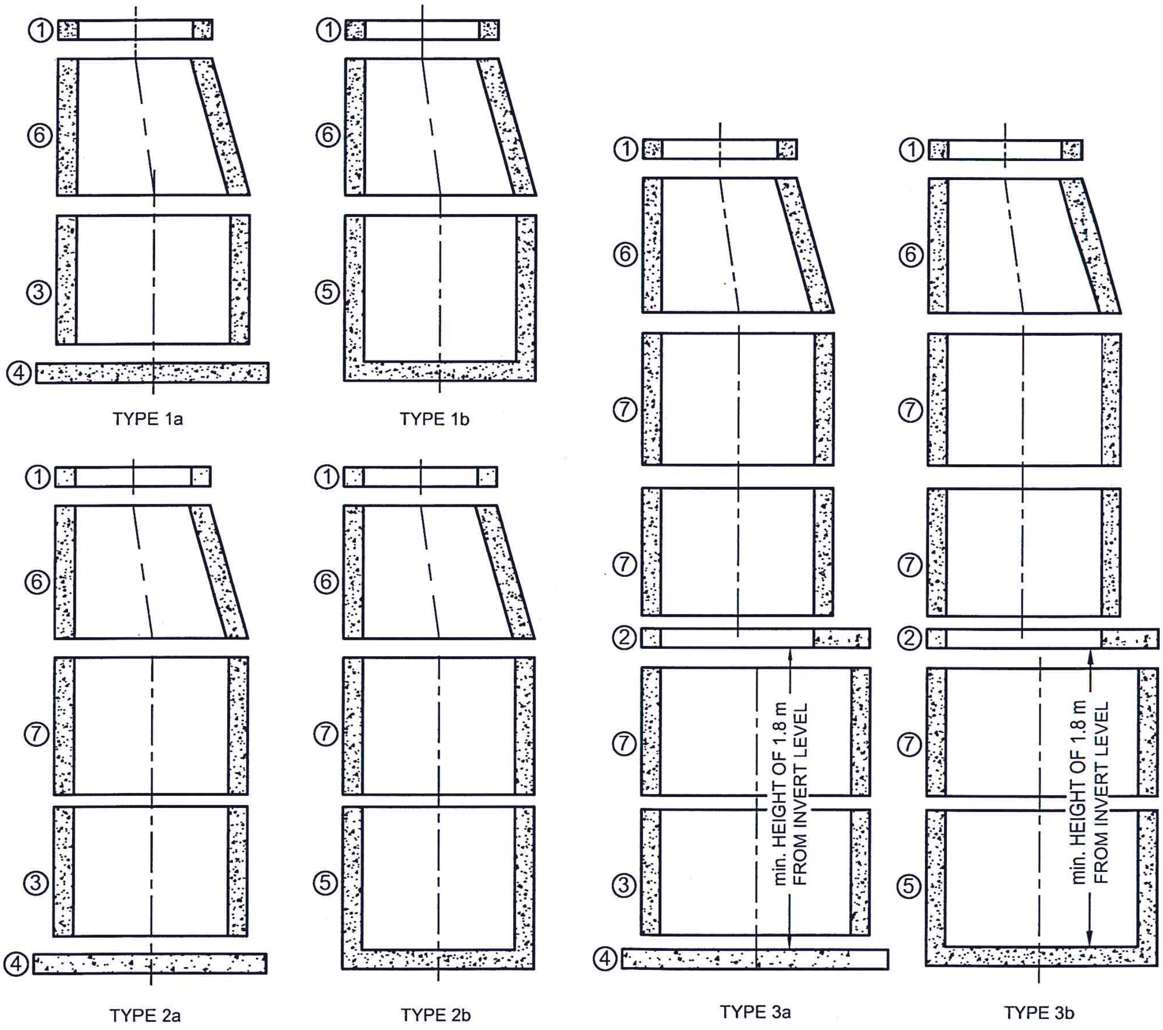
4.2.1.1 *Base riser*

It is vertical component with appropriate joints to provide watertight connections with pipelines, with or without integral connecting pipe(s) or adaptor(s). Base riser may be cast monolithically with base slab or as a separate unit. Riser section consists of a cylindrical section with an effective height of 300 mm to 1 500 mm.

Table 1 Diameter of Manhole

(*Clause* 4.1)

Sl No.	Type as per Fig. 1	Diameter of Sewer mm	Depth of Manhole Chamber m	Diameter of Manhole Chamber mm
(1)	(2)	(3)	(4)	(5)
i)	1a, 1b	200 to 400	Up to 1.65	1 000/1 200
ii)	1a, 1b	200 to 600	Up to 1.65	1 200
iii)	2a, 2b	200 to 700	Up to 2.30	1 200
iv)	2a, 2b, 3a, 3b	200 to 900	2.30 to 8.00	1 500
v)	2a, 2b, 3a, 3b	1 000 to 1 200	2.30 to 8.00	1 800
vi)	2a, 2b, 3a, 3b	1 400 to 1 800	Up to 8.00	2 100


①
⑥
③
④
TYPE 1a
①
⑥
⑤
TYPE 1b
①
⑥
⑦
③
④
TYPE 2a
①
⑥
⑦
⑤
TYPE 2b
①
⑥
⑦
⑦
②
⑦
③
④
min. HEIGHT OF 1.8 m FROM INVERT LEVEL
TYPE 3a
①
⑥
⑦
⑦
②
⑦
⑤
min. HEIGHT OF 1.8 m FROM INVERT LEVEL
TYPE 3b

KEY
1. PRECAST FRAME AND COVER / ADJUSTING UNIT
2. TRANSITION SLAB
3. BASE RISER
4. BASE SLAB
5. MONOLITHIC BASE SLAB AND RISER
6. CONE SECTION
7. RISER UNIT

Fig. 1 Typical Arrangement of Different Types of Precast Concrete Circular Manhole

4.2.1.2 *Base slab*

Precast base slabs may be integral with the base riser or a separate slab incorporating joints (*see* Fig. 2). Base slab transfers the loads of sewage and traffic from riser units to the soil safely.

The description of benching given in Fig. 2 is only for reference. The benching may be precast or cast *in-situ* or the same may be cast monolithically along with the base slab and base riser which have been cast as one unit. M 20 concrete with slope 1 : 12 should be used for benching.

4.2.2 *Cone Section*

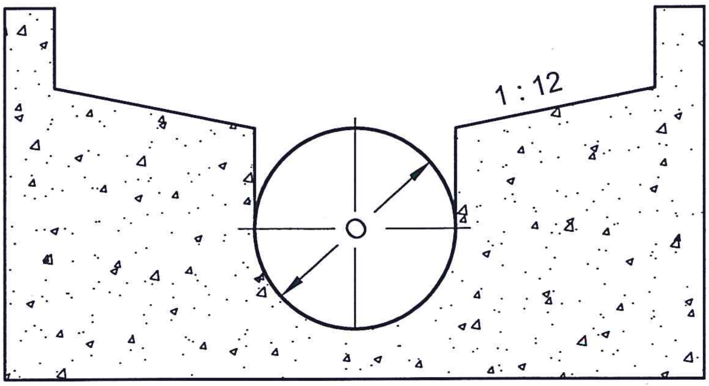
Cone section is commonly installed on the top of the riser section. The function of the cone section is to reduce the diameter of the top cover and still provide an opening large enough for a person to enter into the precast manhole system. Also, the cone section has the function of distributing an eventual traffic load to the riser sections and further down to the base section. By using eccentric cones, a straight vertical access is provided for the persons entering the precast manhole system. Cone Section may be manufactured with or without manhole frame arrangement. The top opening of the cone section is Ø 560 mm. However essentially tongue and groove joint/L-Joint/internal flush joint between cone and frame shall be provided to take care of shear loads.

4.2.3 *Cover and Frame*

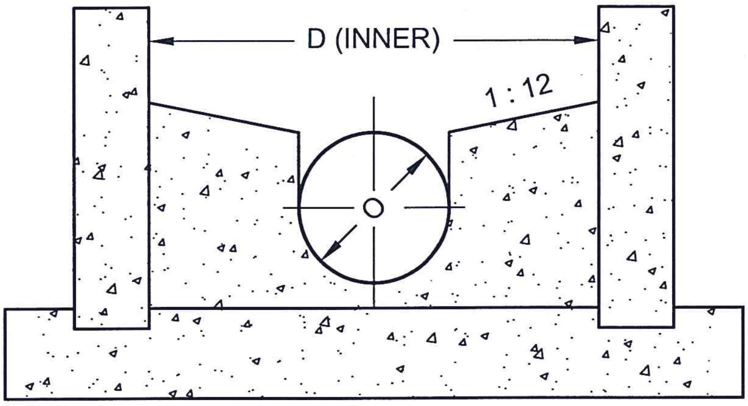
The function of the cover and frame is to close the access to the manhole. The cover and frame used for circular precast concrete manhole shall be as per IS 12592.

4.2.4 *Riser Unit*

The function of riser unit is to provide a safe access connection from ground level to the pipeline. Riser section consists of a cylindrical section with an effective depth of 300 mm to 1 500 mm. The provision for house service connection in the riser section of the manhole may be provided, and if provided then dummy hole deep impression having minimum thickness of wall of 50 mm at that location for facilitating house service connection, should be provided.



2A Monolithically Cast Base Slab and Base Riser Unit



2B Base Slab and Base Riser Unit Cast as Separate Unit

Fig. 2 Typical Detail of Precast Concrete Circular Manhole Base Unit

4.2.5 *Transition Slab*

Transition slab (*see* Fig. 3) is a component that serves to connect base section of the manhole to access shaft of diameter 1 200 mm. The type of joint shall be matched with its bottom and top components.

4.2.6 *Adjusting Unit*

The adjusting unit (*see* Fig. 4) is used to bring the top level of the precast manhole system to match the ground level/any other specified level with any type of joint matching with its bottom and top components.

4.2.7 *Lifting Arrangement*

Precast manhole units may be manufactured with lifting arrangement, the lifting arrangement may be provided as per Annex B or as per the agreement between the manufacturer and the purchaser.

4.2.8 *Footstep*

Precast manhole chamber may be manufactured with footsteps as per the detail given in Annex C or as per the agreement between manufacture and the purchaser.

4.2.9 *Rocker Pipe*

The function of the rocker pipe is to take care the stress developed due to the excessive differential settlement between manhole and the pipeline. To prevent this, the first pipe in the line from the manhole can be restricted in the length. This is known as a rocker pipe. Rocker pipe is not required in case of other than concrete incoming and outgoing pipes.

5 DIMENSIONS AND REINFORCEMENT DETAIL

The dimensions and minimum reinforcement of various components shall be as given in Table 2. A typical sketch of dimension and arrangement of reinforcement are given in Annex D.

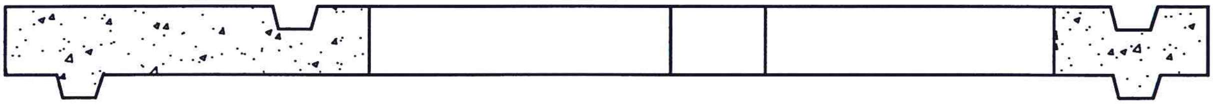


Fig. 3 Transition Slab

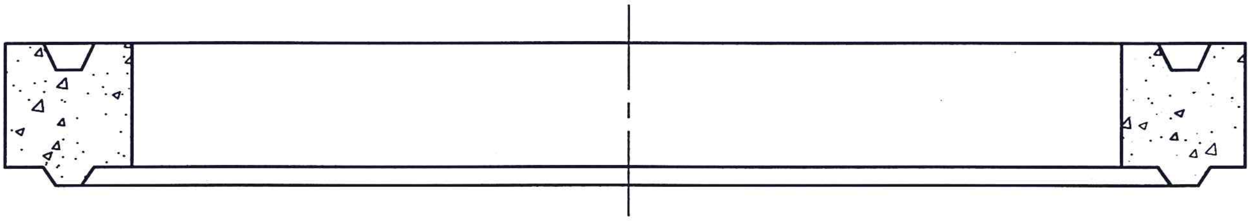


Fig. 4 Adjusting Unit

Table 2 Reinforcement Details of Components of Precast Concrete Manhole

(*Clauses* 5 *and* 10.1)

Sl No.	**Manhole Component**	**Internal Diameter** mm	**Minimum Thickness** mm	**Height** mm	**Reinforcement Details**				
					Longitudinal		Circumferential		Remarks
					Dia mm	Pitch mm	Dia mm	Pitch mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
i)	**Base slab and base riser**								
	a) Base slab and base riser cast separately								
	1) Base riser								
		1 000	125	300, 450, 600, 900	8	200	8	150	Single layer reinforcement shall be placed at the centre, of the two vertical faces of the section. Detailing around pipe opening shall be followed as per **9.6** of SP 34
		1 200	125	300, 450, 600, 900	8	200	8	130	
		1 500	125	300, 450, 600, 900, 1 200, 1 500	10	125	8	110	
		1 800	150	300, 450, 600, 900, 1 200, 1 500,	10	160	10	140	
		2 100	175	300, 450, 600, 900, 1 200, 1 500, 1 800	8	200	8	150	Reinforcement shall be placed on both inside face and outside face. Detailing around pipe opening shall be followed as per **9.6** of SP 34
	2) Base slab								
		1 000	150	–	8	200	8	200	The reinforcement shall be placed in mesh/grid pattern, on both top face and bottom face of Base unit. Base slab projection from outer edge of wall shall be as follows: a) 1 000 mm Dia manhole = 150 mm b) 1 200 mm Dia manhole = 200 mm c) 1 500 mm Dia manhole = 250 mm d) 1 800 mm Dia manhole = 300 mm e) 2 100 mm Dia manhole = 325 mm
		1 200	150	–	8	200	8	200	
		1 500	200	–	8	140	8	140	
		1 800	200	–	10	125	10	125	
		2100	250	–	10	125	10	125	
	b) Base slab and base riser cast monolithically without base slab projection								
	1) Base riser								

Table 2 (*Continued*)

Sl No.	**Manhole Component**	**Internal Diameter** mm	**Minimum Thickness** mm	**Height** mm	**Reinforcement Details**				
					Longitudinal		Circumferential		Remarks
					Dia mm	Pitch mm	Dia mm	Pitch mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		1 000	125	300, 450, 600, 900	8	200	8	150	Single layer reinforcement shall be placed at centre of the two vertical faces of the section, longitudinal reinforcement shall be developed for Ld/3 length inside base slab. Detailing around pipe opening shall be followed as per **9.6** of SP 34
		1200	125	300, 450, 600, 900	8	200	8	130	
		1500	125	300, 450, 600, 900, 1 200,	10	125	8	110	
		1800	150	300, 450, 600, 900, 1 200, 1 500	10	160	10	140	
		2 100	175	300, 450, 600, 900, 1 200, 1 500,1 800	8	200	8	150	Reinforcement shall be placed in both inside face and outside face. longitudinal reinforcement shall be developed for Ld/3 length inside base slab. Detailing around pipe opening shall be followed as per **9.6** of SP 34
	2) Base slab								
		1 000	150	–	8	200	8	200	The reinforcement shall be placed in mesh/grid pattern, on both top face and bottom face of base unit.
		1 200	150	–	8	200	8	200	
		1 500	200	–	8	140	8	140	
		1 800	200	–	8	100	8	100	
		2 100	250	–	8	110	8	110	
ii)	**Adjusting unit**	560	125	50, 75, 100	8	200	8	–	2, 3 and 4 Nos. 8 mm dia. bars shall be provided circumferentially for 50, 75 and 100 high units, respectively
iii)	**Transition slab**	1 500	200	1 200	12	100	12	100	Reinforcement mesh shall be placed in both top and bottom face in mesh arrangement. Detailing around slab opening shall be followed as per **9.6** of SP 34
		1 800	250	1 200 (Clear opening)	16	100	16	100	
		2 100	325	1 200 (Clear opening)	20	130	20	130	
		1 800	150	1 200 (clear height of sloped portion)	12	200	12	200	
		2 100	175	1 200 (clear height of sloped portion)	8	200	8	200	Reinforcement shall be placed in both inside face and outside face.

Table 2 (*Concluded*)

Sl No.	Manhole Component	Internal Diameter mm	Minimum Thickness mm	Height mm	Reinforcement Details				
					Longitudinal		Circumferential		Remarks
					Dia mm	Pitch mm	Dia mm	Pitch mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
iv)	**Riser unit**								
		1 000	125	300, 450, 600, 900	8	200	8	150	Single layer reinforcement shall be placed at centre, of the two vertical of the section.
		1 200	125	300, 450, 600, 900	8	200	8	130	
		1 500	125	300, 450, 600, 900, 1 200, 1 500	10	125	8	110	
		1 800	150	300, 450, 600, 900, 1 200, 1 500	10	160	10	140	
		2 100	175	300, 450, 600, 900, 1 200, 1 500	8	200	8	150	Reinforcement shall be placed in both inside face and outside face.
v)	**Cone section**								
		1 200	125	900 (clear height of sloped portion)	8	200	8	200	Single layer reinforcement shall be placed at centre, of the two vertical of the section.
		1 500	125	1 200 (clear height of sloped portion)	12	200	12	200	
		1 800	150	1 200 (clear height of sloped portion)	12	200	12	200	
		2 100	175	1 200 (clear height of sloped portion)	8	200	8	200	Reinforcement shall be placed in both inside face and outside face.
vi)	**Rocker pipe**	Rocker pipe specifications and joint configuration shall be as per IS 458 as per the incoming and outgoing sewer pipeline diameter. The length of rocker pipe beyond the manhole shall be between 300 mm and 500 mm with a tolerance of ± 4 mm.							

NOTES

1 Details given in the Table 2 are applicable for the manholes up to 8 m depth below ground level and invert level of sewer pipe greater than or equal to 8 m from GL, for heavy traffic.

2 For the other cases detailed structural design according to IS 456 and other relevant Indian Standards shall be done and the manufacturer to provide the details.

3 Grade of concrete = M 35.

4 Grade of reinforcement = Fe 500.

5 Co-efficient of active earth pressure at rest (Ka) = 1.

6 Density of soil considered = 1.8 t/m^3.

7 Density of sewage considered = 1.05 t/m^3.

8 Net SBC of soil considered = 8.0 t/m^2.

9 Water table is considered at ground level for design purpose.

10 Design is done by limit state method with a design crack width of 0.2 mm.

11 Development length and lap length shall be as per IS 456.

12 For the base risers to be fitted with RCC pipe, the wall thinness of the base unit can be increased in order to accommodate the incoming and outgoing pipe diameter connection.

6 MATERIALS

6.1 Cement

Cement complying with any of the following Indian Standards may be used:

a) Ordinary Portland cement conforming to IS 269,

b) Portland slag cement conforming to IS 455,

c) Portland pozzolana cement conforming to IS 1489 (Part 1),

d) Portland pozzolana cement, calcined clay based conforming to IS 1489 (Part 2),

e) Supersulphated cement conforming to IS 6909,

f) Rapid hardening Portland cement conforming to IS 8041,

g) Sulphate resisting Portland cement conforming to IS 12330, and

h) Hydrophobic cement conforming to IS 8043.

NOTES

1 The manufacturer shall give a certificate indicating the type and quantity of cement used in the concrete mix.

2 Site blending with fly ash up to a maximum of 30 percent may be carried out provided its uniform blending with ordinary Portland cement is ensured.

3 Site blending with GGBS up to a maximum of 50 percent may be carried out provided its uniform blending with ordinary Portland cement is ensured.

4 Blending of any one out of fly ash and GGBS is permitted.

6.2 Aggregates

6.2.1 Fine and coarse aggregates used in the manufacture shall conform to IS 383. The coarse aggregate shall be graded aggregate of maximum 20 mm nominal size.

6.2.2 The maximum nominal size of coarse aggregates may be as large as possible within the limits specified but in no case greater than one-fourth of the minimum thickness of the unit.

6.3 Pulverized Fuel Ash

Pulverized fuel ash, if used shall conform to IS 3812 (Part 1).

6.4 Ground Granulated Blast Furnace Slag

Ground granulated blast furnace slag, if used shall conform to IS 16714.

6.5 Additives or Chemical Admixtures

Additives or chemical admixtures may be added in the preparation the concrete mix. Chemical admixture used shall conform to IS 9103.

6.6 Reinforcement

Steel for reinforcement of concrete complying with any of the following standards may be used:

a) Mild steel and medium tensile steel bars conforming to IS 432 (Part 1);

b) Hard-drawn steel wire conforming to IS 432 (Part 2);

c) High strength deformed steel bars and wires conforming to IS 1786; and

d) Hot rolled medium and high tensile structural steel conforming to IS 2062.

6.7 Water

The water used in production shall conform to the requirements specified in IS 456.

7 MANUFACTURE

All precast concrete manhole components should be manufactured under hydraulic pressure/mechanical hydraulic vibration and compaction with design mix concrete as specified in IS 456. The concrete used in the manufacture of precast concrete manhole components shall not be lower than M 35. The minimum nominal cover for reinforcement shall be 30 mm. However, nominal cover may be increased depending on the severity of site conditions. The method of manufacture should be such that the forms and dimensions of the finished product are accurate within the limits specified in this standard. The surfaces and edges should be well defined and true, and their ends should be square with the longitudinal axis. Concrete should be weight in weigh batcher and mixed in mechanical mixer. Mixing should be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case should the mixing be done for less than 2 min for a batch.

8 TOLERANCE

The individual components shall be manufactured within the tolerances given in Table 3.

Table 3 Dimensional Tolerances

(*Clauses* 8 *and* 10.1)

Sl No.	Dimension	Tolerances
(1)	(2)	(3)
i)	Height	± 1 percent
ii)	Internal diameter	
	a) Up to and including 1 200 mm	± 3 mm
	b) Above 1 200 mm and up to and including 1 500 mm	± 5 mm
	c) Above 1 500 mm	± 10 mm
iii)	Thickness	$^{+7}_{-3.5}$ mm

9 TYPES OF JOINTS

Precast manhole components can be joined together with different types of joints as follows and for achieving the desired degree of tightness sealing material like elastomeric/plastomeric/mortar/sealing material other may be used.

a) *Tongue and groove joint*

This joint provides a very high degree of tightness of the joint and allows the individual components in the precast manhole system to move small distances away from their ideal position without causing the joints to leak. Typical details of the tongue and groove joint are given in Fig. 5.

b) *Internal flush joint*

This joint prevents the precast manhole components to dislocate from their ideal positions. Typical detail of the internal flush joint are given in Fig. 6.

c) *Single offset joint*

This joint provides the high degree of tightness of the joint. Typical details of the single offset joint are given in Fig. 7.

10 PHYSICAL REQUIREMENTS

10.1 Dimensions

The dimensions of the manhole components shall be in accordance with Table 2 subject to the tolerances mentioned in Table 3.

10.2 Compressive Strength

The concrete used in manufacture of Precast Concrete Manhole units shall not be less than M 35 Grade when tested in accordance with IS 516 (Part 1/Sec 1), and the minimum cementitious content shall be 360 kg/m^3.

10.3 Water Absorption

Manhole components, when tested for water absorption in accordance with IS 3597, shall not be more than 5 percent, when immersed in water for 24 hour. The size of the sample used for testing shall have square area of 100 cm^2 ± 10 percent with full thickness.

10.4 Strength Requirement

10.4.1 *Riser Unit and Adjusting Ring*

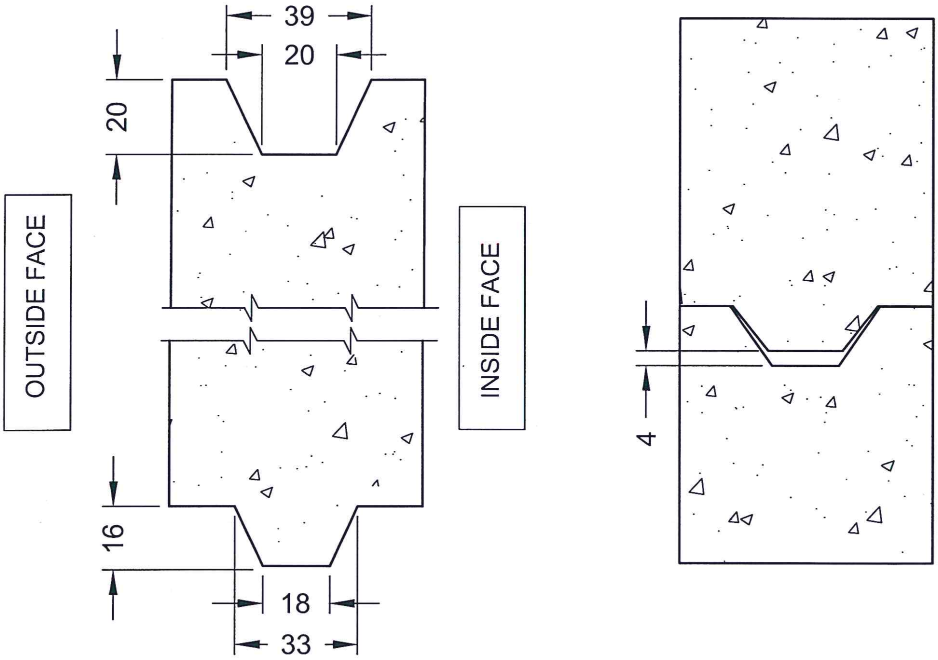
10.4.1.1 The strength requirement for riser unit when tested according to Annex E shall be as given in Table 4.

Table 4 Strength Requirement

(*Clause* 10.4.1.1)

Sl No.	Internal Diameter of Manhole mm	Minimum Strength Requirement kN/linear metre
(1)	(2)	(3)
i)	1 000	47.90
ii)	1 200	57.48
iii)	1 500	67.06
iv)	1 800	86.22
v)	2 100	95.80

10.4.1.2 The minimum strength requirement for adjusting unit when tested in accordance with Annex E shall be 23.95 kN/linear metre.



All dimensions in millimetres.

FIG. 5 TYPICAL DETAILS OF TONGUE AND GROOVE JOINT

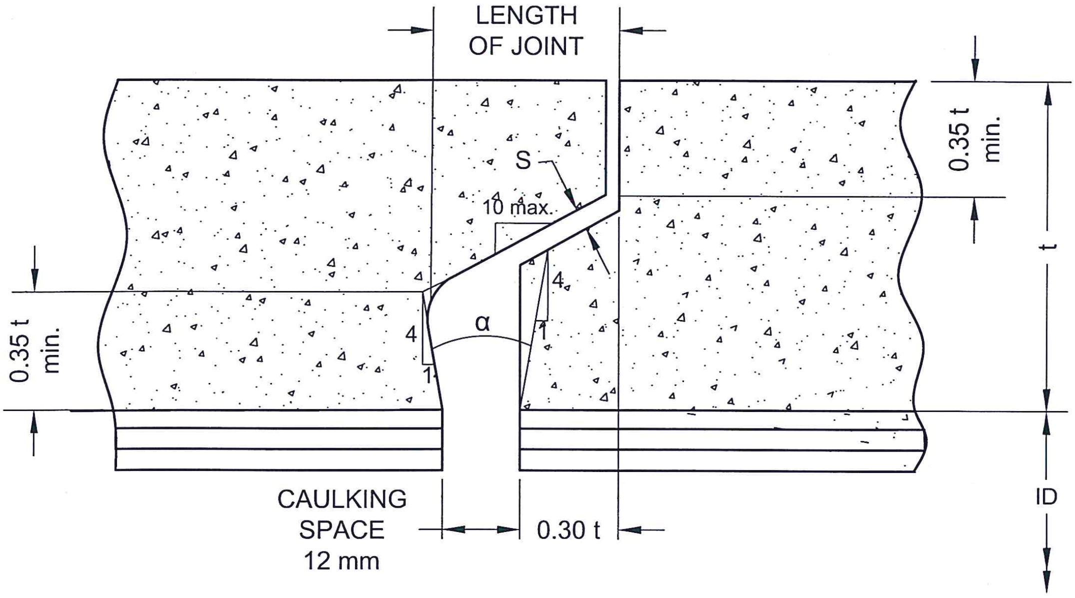
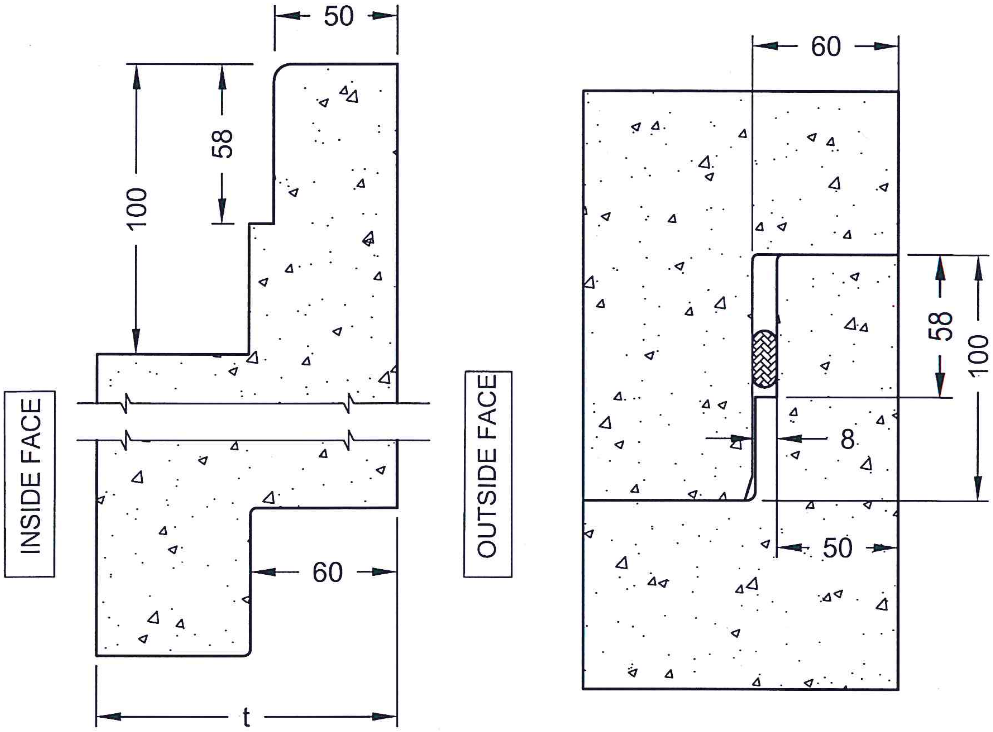


FIG. 6 TYPICAL DETAILS OF INTERNAL FLUSH JOINT



All dimensions in millimetres.

FIG. 7 TYPICAL DETAILS OF SINGLE OFFSET JOINT

10.4.2 *Cone Section and Transition Slab*

The strength requirement for cone section and transition slab when tested in accordance with Annex E shall not be less than 300 kN.

10.5 Workmanship and Finish

10.5.1 Manhole shall be free from local dents or bulges greater than 3.0 mm in depth and extending over a length in any direction greater than twice the barrel wall thickness.

10.6 Hydrostatic Pressure Test

Every Component of the manhole unit shall be tested for Hydrostatic pressure of 0.07 N/mm^2 as per Annex F and no leakage shall be observed in the stipulated time.

11 SAMPLING AND CRITERIA FOR CONFORMITY

11.1 Scale of Sampling

11.1.1 *Lot*

The precast concrete manhole component of same size and belonging to the same mix of concrete produced in one day shall be grouped together to constitute a lot.

11.1.2 These precast manhole components shall be selected at random. In order to ensure the randomness of selection, procedures given in IS 4905/ISO 24153 may be followed. The number of precast manhole component to be selected from the lot shall depends upon the lot size and shall be in accordance with Table 5.

11.2 Number of Tests and Criteria for Conformity

11.2.1 Each precast concrete manhole component selected in accordance with col 2 and col 3 of Table 5 shall be subjected to tests for dimensional requirements. Any precast manhole component failing to meet one or more of the requirement shall be considered as defective. If the number of precast concrete manhole component found defective is less than or equal to the corresponding acceptance number given in col 4, the lot shall be considered as conforming to the dimensional requirements.

11.2.2 The lot which has been found as conforming to the dimensional requirement shall then be subjected to strength requirement test. For this purpose, the number of precast concrete manhole components to be selected shall be in accordance with col 2 and col 5 of Table 5. The lot shall be considered as conforming to these requirements if no defective is found.

11.2.3 The lot shall be considered as conforming to the requirements of the specification if **11.2.1** and **11.2.2** are satisfied

12 MARKING

12.1 The following information shall be clearly and indelibly marked on the outside of each precast concrete manhole component:

a) Indication of the source of manufacture,
b) Name of the component (*see* **4.2**),
c) Size of precast concrete manhole component, and
d) Batch number and date of manufacturing.

12.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

Table 5 Sampling of Precast Concrete Circular Manholes

(*Clauses* 11.1.2, 11.2.1 *and* 11.2.2)

Sl No.	Lot Size *N*	Sample Size for Dimensional Requirements	Acceptance Number	Sample Size *n*
(1)	(2)	(3)	(4)	(5)
i)	Up to 50	1	0	1
ii)	51 to 150	2	0	2
iii)	151 to 300	4	1	3
iv)	301 to 500	6	2	4
v)	501 and above	10	3	5

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
210 : 2009	Grey iron castings — Specification (*fifth revision*)
269 : 2015	Ordinary portland cement — Specification (*sixth revision*)
383 : 2016	Coarse and fine aggregate for concrete — Specification (*third revision*)
432	Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement
(Part 1) : 1982	Mild steel and medium tensile steel bars (*third revision*)
(Part 2) : 1982	Hard-drawn steel wire (*third revision*)
455 : 2015	Portland slag cement — Specification (*fifth revision*)
456 : 2000	Plain and reinforced concrete — Code of practice (*fourth revision*)
458 : 2021	Precast concrete pipes (with and without reinforcement) — Specification (*fifth revision*)
516 (Part 1/Sec 1) : 2021	Hardened Concrete Methods of Test: Part 1 Testing of strength of hardened concrete, Section 1 Compressive, flexucal and split tensile strength (*first revision*)
1489	Portland pozzolana cement — Specification
(Part 1) : 2015	Fly ash based (*fourth revision*)
(Part 2) : 2015	Calcined clay based (*fourth revision*)
1786 : 2008	High strength deformed steel bars and wires for concrete reinforcement — Specification (*fourth revision*)
2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)
3597 : 1998	Concrete pipes — Methods test (*second revision*)
3812	Pulverized fuel ash — Specification
(Part 1) : 2013	For use as pozzolana in cement, cement mortar and concrete (*third revision*)
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
5455 : 1969	Specification for cast iron steps for manholes
6909 : 1990	Supersulphated cement — Specification (*first revision*)
8041 : 1990	Rapid hardening portland cement — Specification (*second revision*)
8043 : 1991	Hydrophobic portland cement (*second revision*)
9103 : 1999	Concrete admixtures — Specification (*first revision*)
10910 : 1984	Specification for polypropylene and its copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
12330 : 1988	Specification for sulphate resisting portland cement
12592 : 2002	Precast concrete manhole cover and frame — Specification (*first revision*)
16714 : 2018	Ground granulated blast furnace slag for use in cement, mortar and concrete — Specification

ANNEX B

(*Clause* 4.2.7)

LIFTING HOOK ARRANGEMENT

The location of the lifting holes may be provided as per Fig. 8 to Fig. 10. Suitable Nut and Bolt arrangement may be provided for lifting purpose.

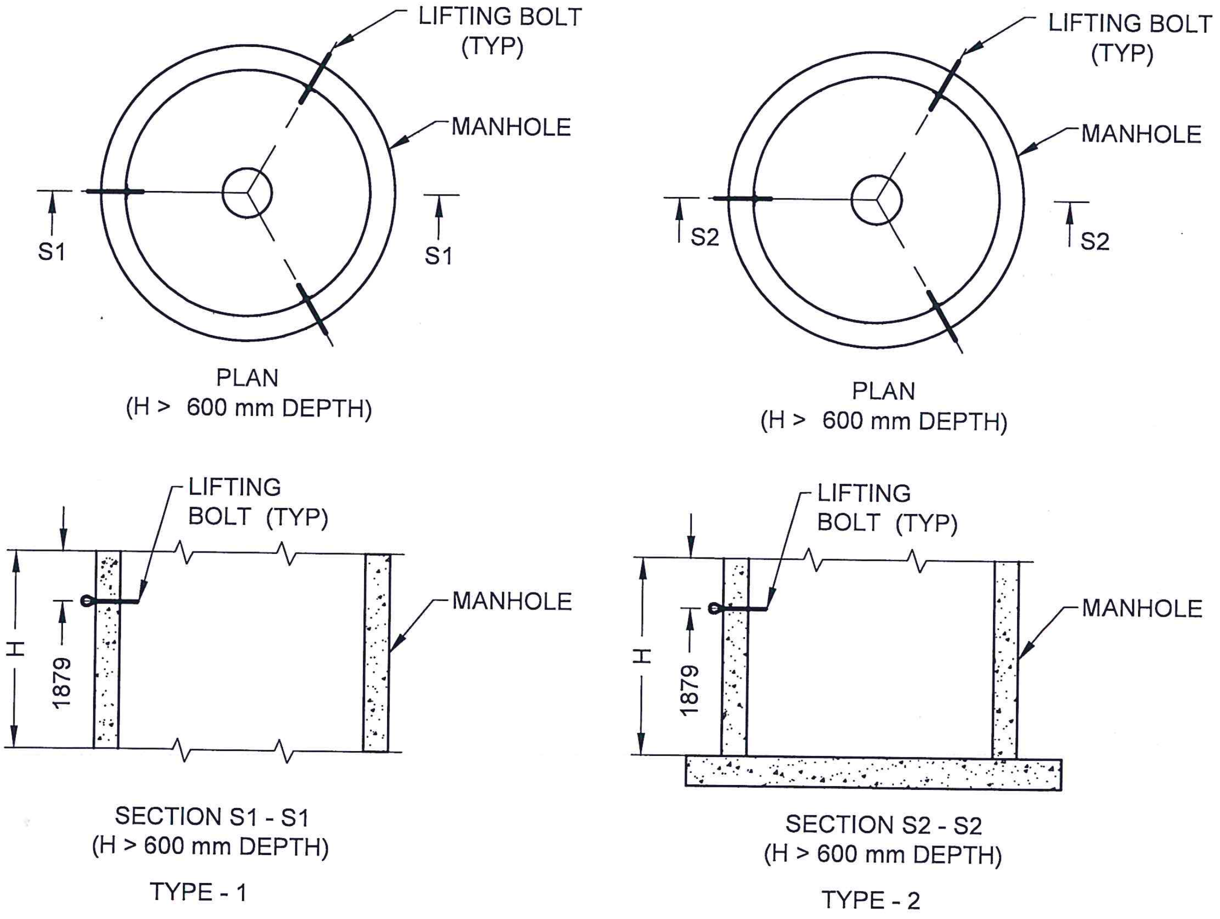
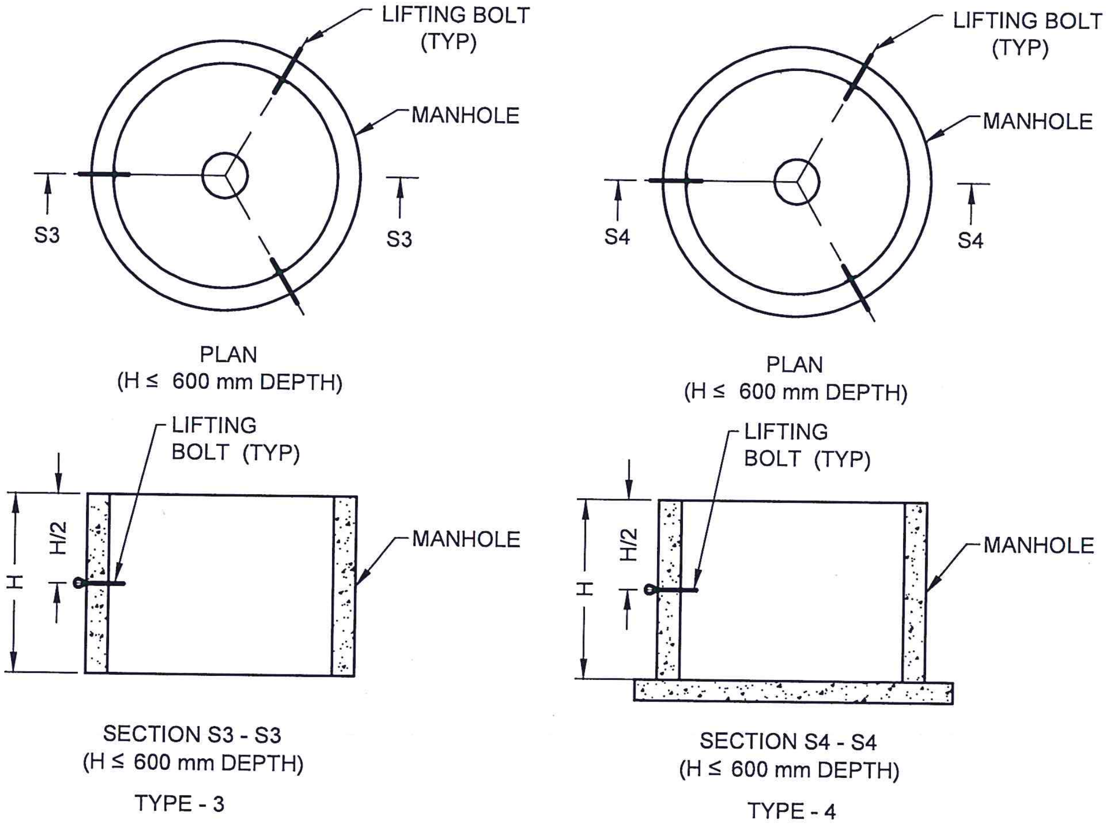


FIG. 8 TYPICAL LOCATION OF LIFTING HOLES FOR $H > 600$ mm DEPTH FOR RISER AND BASE RISER CAST SEPARATELY



PLAN (H ≤ 600 mm DEPTH)

SECTION S3 - S3 (H ≤ 600 mm DEPTH)

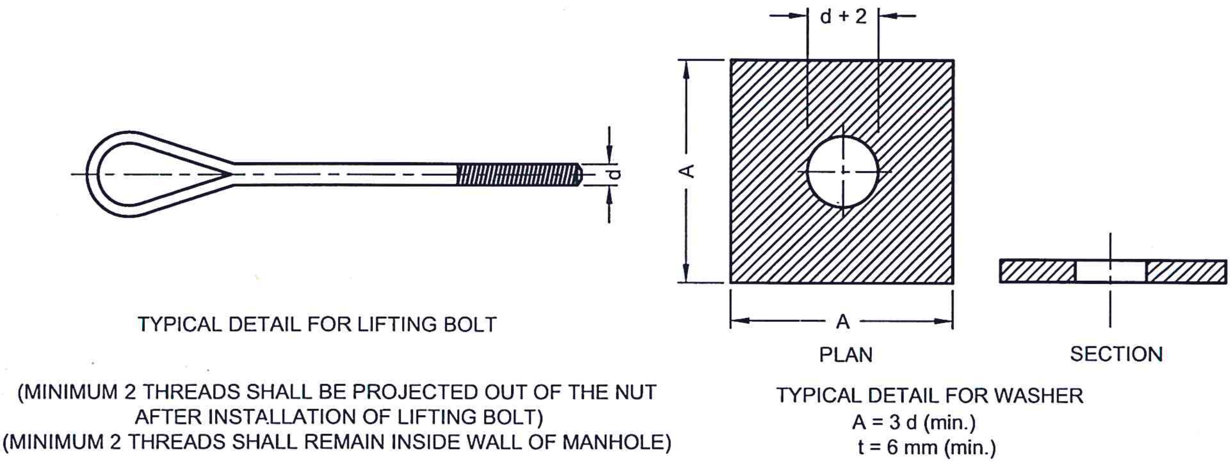
TYPE - 3

PLAN (H ≤ 600 mm DEPTH)

SECTION S4 - S4 (H ≤ 600 mm DEPTH)

TYPE - 4

FIG. 9 TYPICAL LOCATION OF LIFTING HOLES FOR $H \leq 600$ mm DEPTH FOR RISER AND BASE RISER CAST SEPARATELY



TYPICAL DETAIL FOR LIFTING BOLT

(MINIMUM 2 THREADS SHALL BE PROJECTED OUT OF THE NUT AFTER INSTALLATION OF LIFTING BOLT)
(MINIMUM 2 THREADS SHALL REMAIN INSIDE WALL OF MANHOLE)

TYPICAL DETAIL FOR WASHER
A = 3 d (min.)
t = 6 mm (min.)

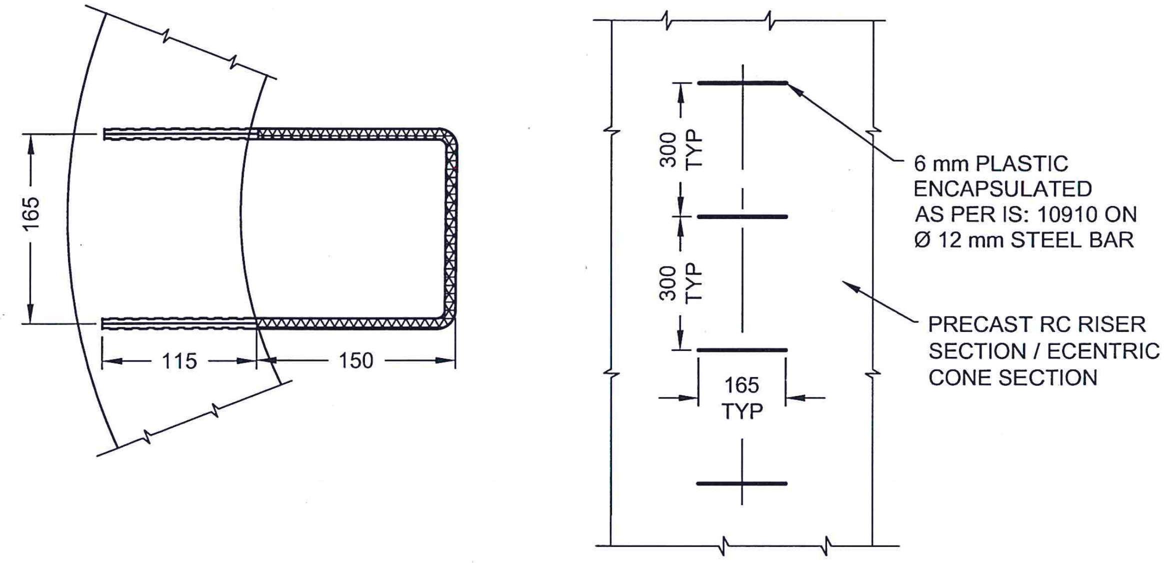
FIG. 10 TYPICAL DETAILS OF LIFTING BOLT

ANNEX C

(*Clause* 4.2.8)

FOOTSTEPS

Footsteps shall be provided in all manholes over 0.8 m in depth. Steps provided in manhole shall conform to IS 5455 when manufactured with any grade of steel as per IS 210 or any other material as per the agreement between the manufacture and the purchaser. PVC encapsulation may be provided as per the IS 10910. These step may be set staggered in two vertical runs which may be 380 mm apart horizontally and 300 mm vertically. The top step shall be 450 mm below the manhole cover and the lowest not more than 300 mm above the benching. A minimum 100 mm projection shall be provided beyond the finished surface of the manhole wall. The minimum width of step shall be 165 mm.


165
115
150
300 TYP
300 TYP
6 mm PLASTIC ENCAPSULATED AS PER IS: 10910 ON Ø 12 mm STEEL BAR
PRECAST RC RISER SECTION / ECENTRIC CONE SECTION
165 TYP

All dimensions in millimetres

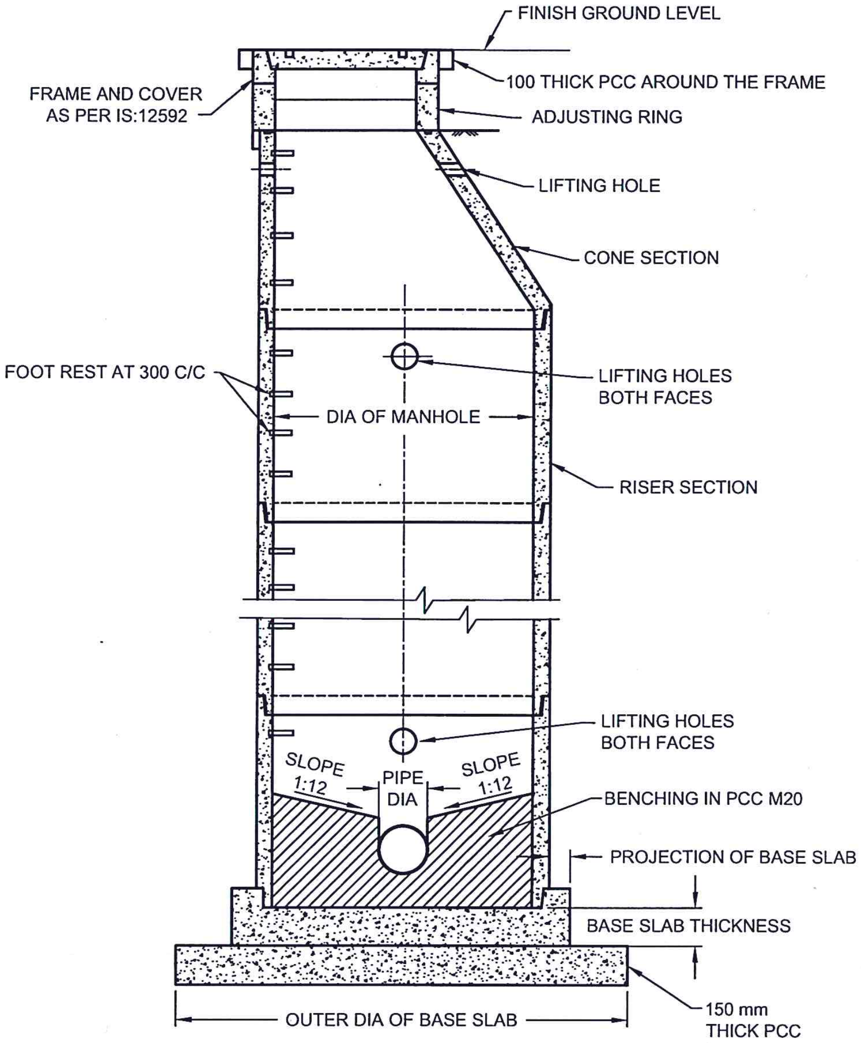
FIG. 11 TYPICAL DETAILS OF FOOTSTEP

ANNEX D

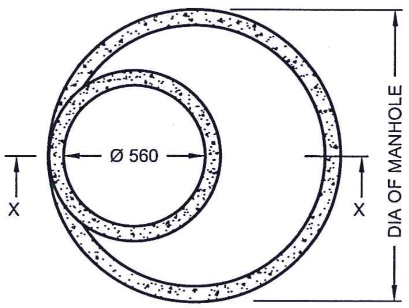
(*Clause* 5)

TYPICAL DIMENSIONS AND ARRANGEMENT OF REINFORCEMENT OF PRECAST CONCRETE CIRCULAR MANHOLE

D-1 Figures 12 to 15 give typical sketches of dimensions and arrangement of reinforcement of precast concrete circular manholes:

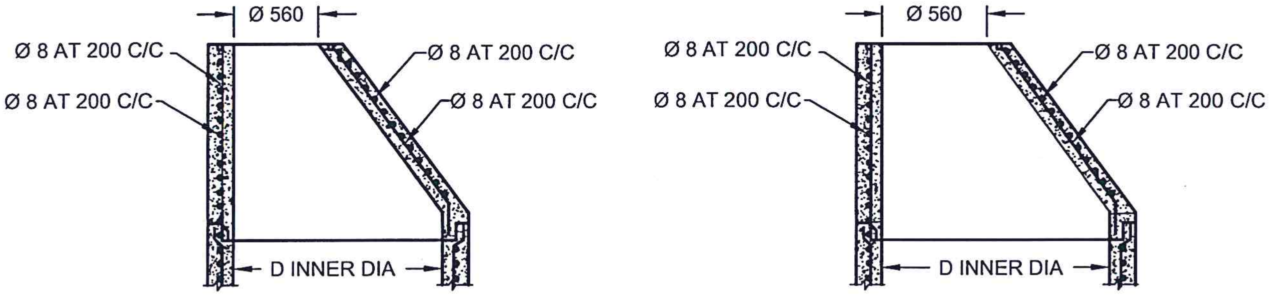


SECTION XX



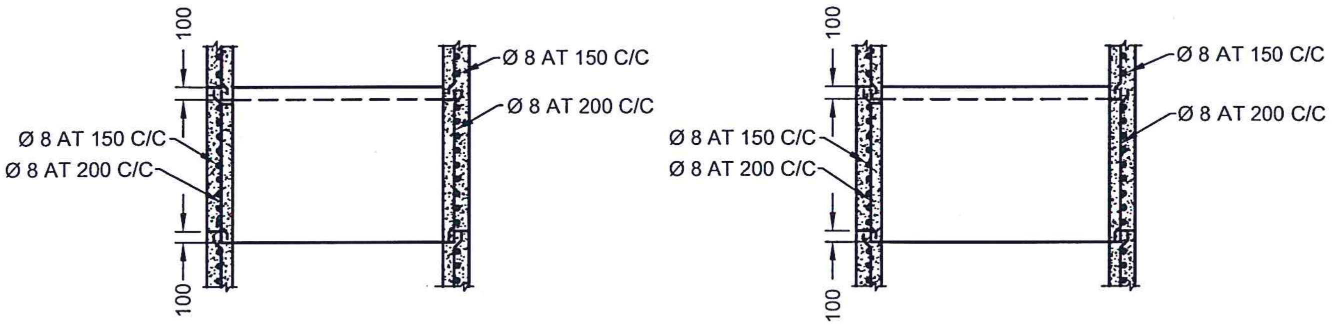
PLAN AT MANHOLE TOP LEVEL

Fig. 12 Typical Plan and Section of Precast Concrete Circular Manhole



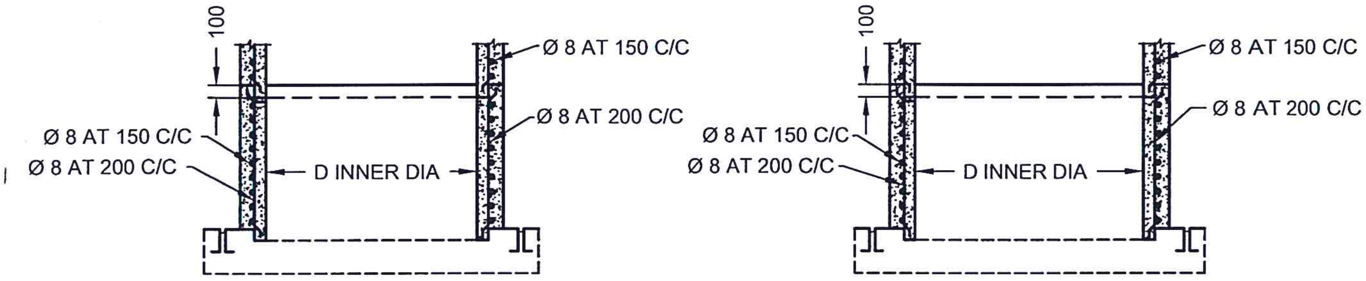
REINFORCEMENT DETAIL OF RISER SECTION (FOR 1000 Ø MANHOLE)

REINFORCEMENT DETAIL OF RISER SECTION (FOR 1200 Ø MANHOLE)



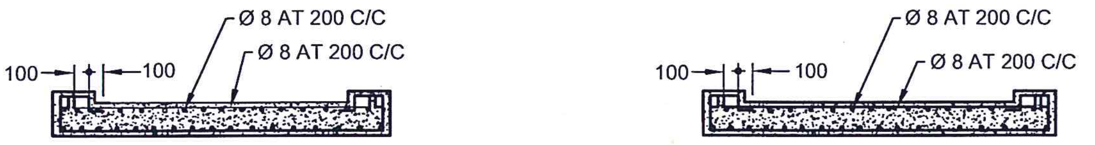
REINFORCEMENT DETAIL OF RISER SECTION (FOR 1000 Ø MANHOLE)

REINFORCEMENT DETAIL OF RISER SECTION (FOR 1200 Ø MANHOLE)



REINFORCEMENT DETAIL OF RISER SECTION (FOR 1000 Ø MANHOLE)

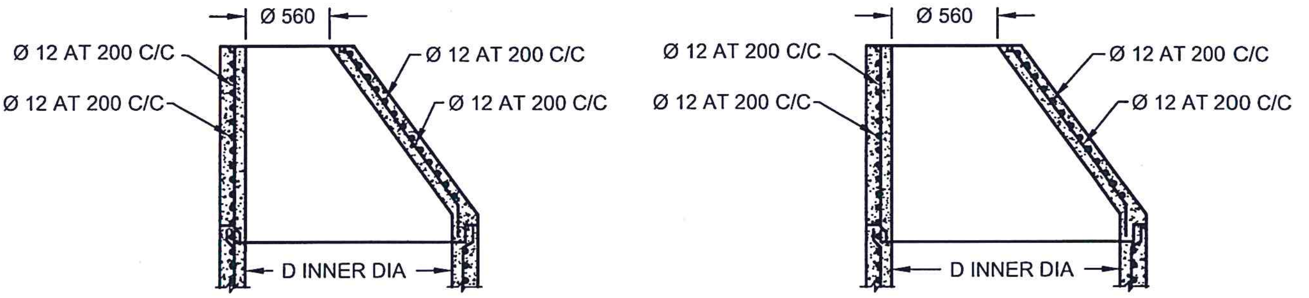
REINFORCEMENT DETAIL OF RISER SECTION (FOR 1200 Ø MANHOLE)



REINFORCEMENT DETAIL OF BASE SLAB (FOR 1000 Ø MANHOLE)

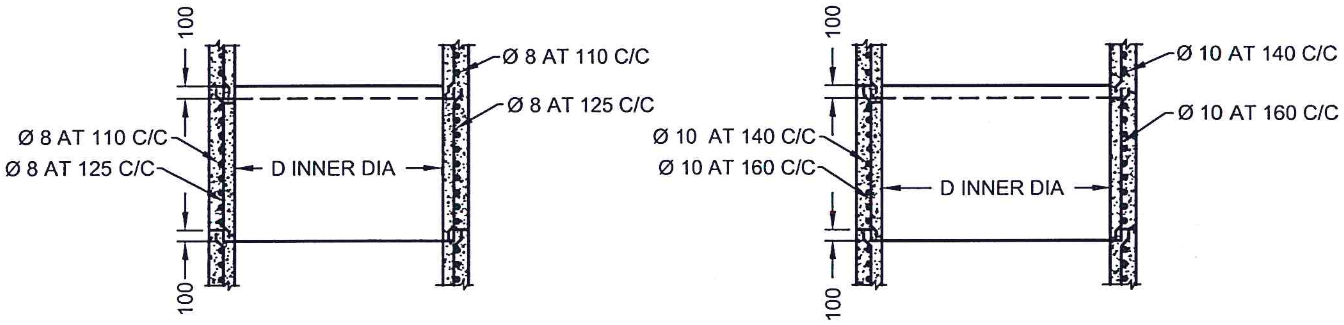
REINFORCEMENT DETAIL OF BASE SLAB (FOR 1200 Ø MANHOLE)

FIG. 13 TYPICAL SKETCH OF DIMENSIONS AND ARRANGEMENT OF REINFORCEMENT OF PRECAST CONCRETE CIRCULAR MANHOLE OF 1 000 mm AND 1 200 mm DIAMETER



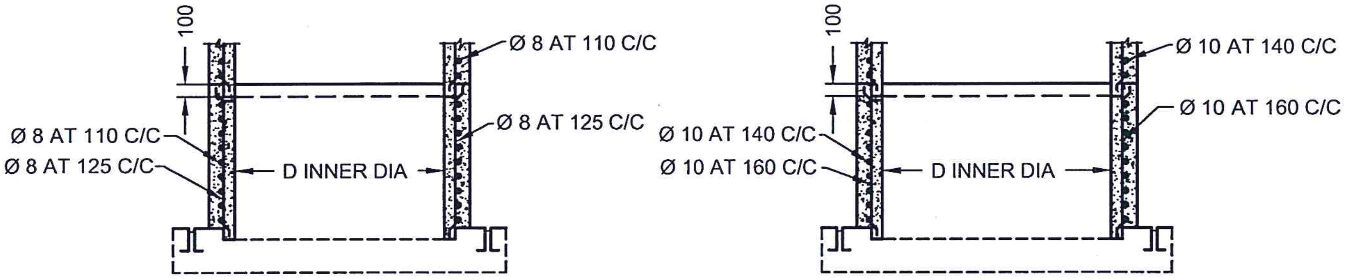
REINFORCEMENT DETAIL OF RISER SECTION (FOR 1500 Ø MANHOLE)

REINFORCEMENT DETAIL OF RISER SECTION (FOR 1800 Ø MANHOLE)



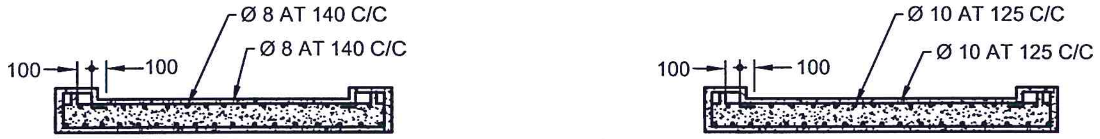
REINFORCEMENT DETAIL OF RISER SECTION (FOR 1500 Ø MANHOLE)

REINFORCEMENT DETAIL OF RISER SECTION (FOR 1800 Ø MANHOLE)



REINFORCEMENT DETAIL OF RISER SECTION (FOR 1500 Ø MANHOLE)

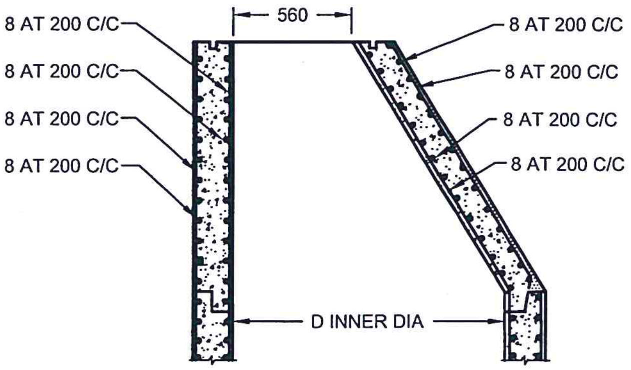
REINFORCEMENT DETAIL OF RISER SECTION (FOR 1800 Ø MANHOLE)



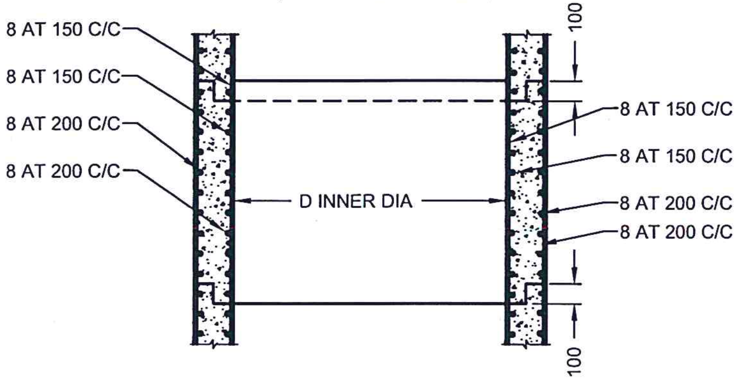
REINFORCEMENT DETAIL OF BASE SLAB (FOR 1500 Ø MANHOLE)

REINFORCEMENT DETAIL OF BASE SLAB (FOR 1800 Ø MANHOLE)

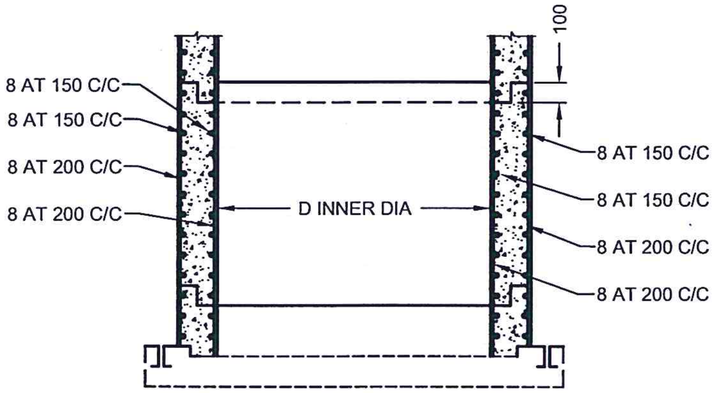
FIG. 14 TYPICAL SKETCH OF DIMENSIONS AND ARRANGEMENT OF REINFORCEMENT OF PRECAST CONCRETE CIRCULAR MANHOLE OF 1 500 mm AND 1 800 mm DIAMETER



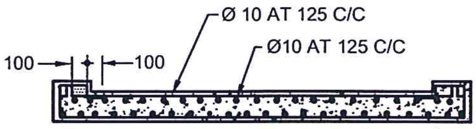
REINFORCEMENT DETAIL OF RISER SECTION
(FOR 2100 Ø MANHOLE)



REINFORCEMENT DETAIL OF RISER
SECTION (FOR 2100 Ø MANHOLE)



REINFORCEMENT DETAIL OF BASE
SLAB (FOR 2100 Ø MANHOLE)



REINFORCEMENT DETAIL OF BASE SLAB
(FOR 2100 Ø MANHOLE)

Fig. 15 Typical Sketch of Dimensions and Arrangement of Reinforcement of Precast Concrete Circular Manhole of 2 100 mm Diameter

ANNEX E

(*Clause* 10.4)

TEST FOR STRENGTH REQUIREMENT

E-1 RISER UNIT AND ADJUSTING UNIT

E-1.1 Test Setup

Riser unit shall be positioned in the testing machine as shown in Fig. 16 and be supported and loaded through elastomeric bearers placed parallel to the unit's longitudinal axis. The bearers may be continuous. The centroid of the load shall be at a distance of *h*/2 from the outside face of the socket and the load shall be distributed uniformly as shown in Fig. 16. For circular units the load shall be applied through one top bearer. The bottom bearer shall be formed as a V-shaped support with an included angle, *p* of 150° ± 3° as shown in Fig. 16. The elastomeric material for bearers shall have a mean hardness of (50 ± 5) IRHD with a thickness of (20 ± 5) mm.

E-1.2 Procedure

During application of the test load, it shall be increased at a rate between 20 kN/m per min and 25 kN/m per min. The reinforced concrete unit shall be able to withstand the specified load for 3 min without showing any crack.

E-2 CONE SECTION AND TRANSITION SLAB

E-2.1 Test Setup

The apparatus shall be equipped with 20 mm steel or cast iron plates, through which the load is applied to the unit whilst it is supported around its perimeter (*see* Fig. 17 and Fig. 18). The dimensions of the steel or cast iron plate shall not exceed more than 125 mm than the dimensions of the access opening. The unit shall be bedded on elastomeric material with a mean hardness of (50 ± 5) IRHD with a thickness of (20 ± 5) mm. If the groove is present, it should be filled with cement mortar (1 : 4).

E-2.2 Procedure

During application of the test load, it shall be increased at a rate between 20 kN/min and 25 kN/m per min. The arrangement of the load application for cone section is shown in Fig. 17. The arrangement of the load application for transition slab is shown in Fig. 18. The unit shall be able to withstand the specified load for 3 min. After removal of load there shall be no crack of width more than 0.15 mm over a continuous length of 300 mm or more, or the full width of a concrete surface, whichever is the smaller.

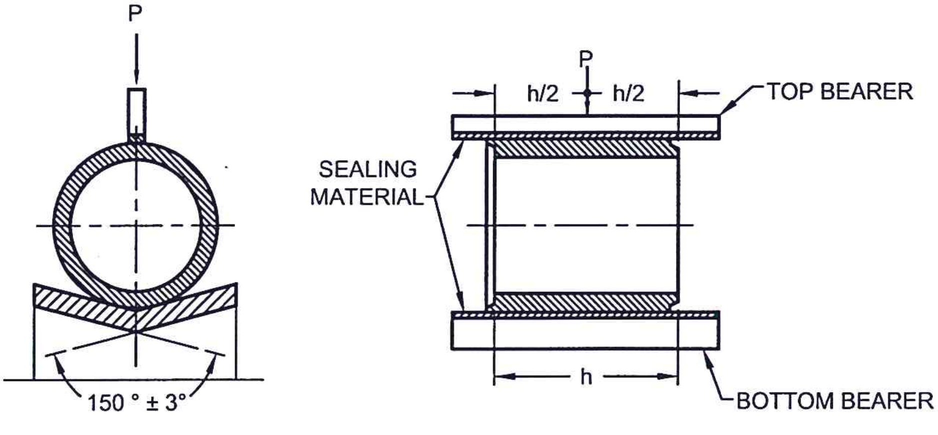


FIG. 16 ARRANGEMENT FOR TEST FOR STRENGTH REQUIREMENT OF RISER UNIT AND ADJUSTING UNIT

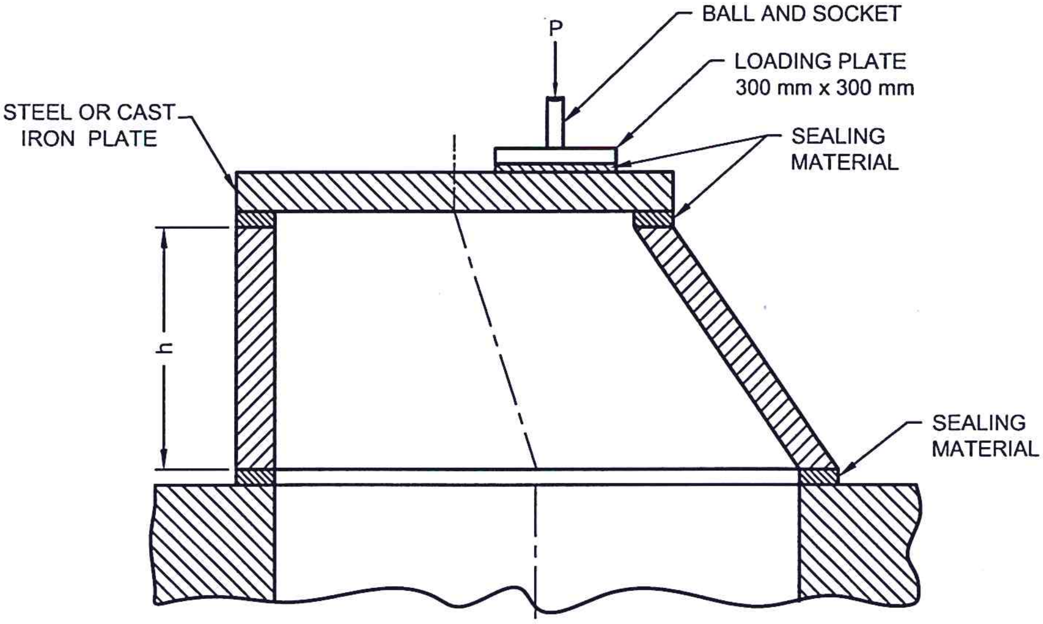


Fig. 17 Strength Requirement Test Arrangement for Cone Section

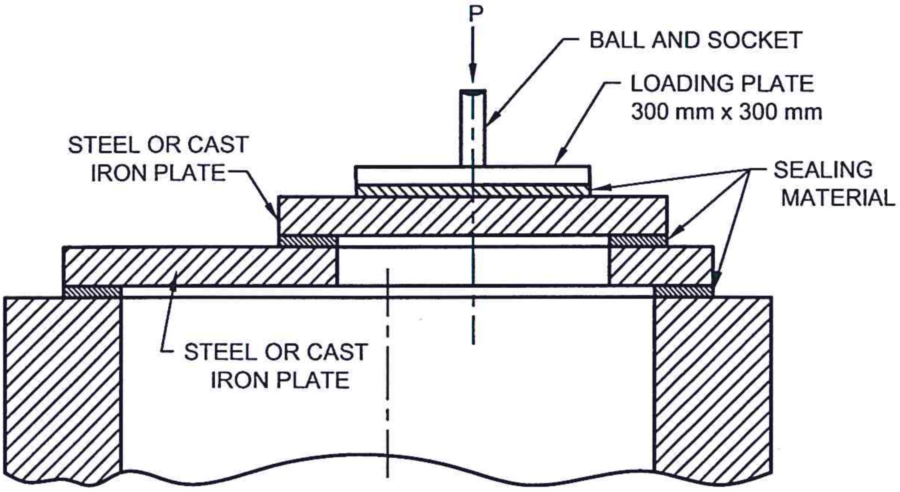


Fig. 18 Strength Requirement Test Arrangement for Transition Slab

ANNEX F

(*Clause* 10.6)

HYDROSTATIC PRESSURE TEST

F-1 TEST SPECIMEN

Every component of the manhole unit for determination of leakage under internal hydrostatic pressure shall be sound. If the specimen is tested after storing in adverse weather condition, presoaking shall be permitted. For presoaking, of the manhole unit shall be submerged in water or sprayed with water for a period not less than 6 h prior to testing and excess water removed.

F-2 PROCEDURE

F-2.1 The test specimen be supported in such a way that the longitudinal axis is approximately horizontal and the exterior surface excepting the supports can be examined readily.

F-2.2 The equipment for making the test shall be such that the specimen under test can be filled with water to the exclusion of air and subjected to the required hydrostatic pressure. Apply hydrostatic pressure to the component of the manhole unit.

F-2.3 The specimen shall be filled with water and the air expelled. Pressure shall be applied at a gradual rate until the specified test pressure is reached, or beads of water on the component of the manhole unit is seen, whichever occurs first.

F-2.4 Pressure shall be maintained for 1 min plus 30 s for each 10 mm of wall thickness, or for twice that entire period if the application of pressure resulted in the formation of beads of water on the component of the manhole unit.

F-2.5 At the end of the holding period, the pressure shall be released immediately if the test pressure has been maintained. If the beads of the water have not grown or run, the pressure shall be increased slowly until the test pressure is reached or the beads of water grow or run (whichever occurs first).

F-2.6 If the test pressure has been reached without the beads of water growing or running, the test pressure shall be maintained constant for 1 min plus 10 s for each 10 mm of wall thickness. At the end of the holding period the pressure shall be released immediately.

After releasing the pressure, the component of the manhole unit used for testing shall be drained completely.

ANNEX G

(*Foreword*)

COMMITTEE COMPOSITION

Cement Matrix Products Sectional Committee, CED 53

Organization	*Representative(s)*
In Personal Capacity (*House No. 131, Sector 11D, Faridabad 121006*), Haryana	Shri V. V. Arora (***Chairman***)
All India AC Pressure Pipe Manufacturers Association, Indore	Shri N. Kishan Reddy Shri P. S. Kalani (*Alternate*)
Ambuja Cements Ltd, Ahmedabad	Shri J. P. Desai Shri B. K. Jagetiya (*Alternate*)
Brihan Mumbai Municpal Corporation, Mumbai	Shri Vishal Thombare
Central Pollution Control Board, Delhi	Shri J. S. Kamyotra Shri P. K. Gupta (*Alternate*)
Central Public Health and Environmental Engineering Organization, New Delhi	Representative
Central Public Works Department, New Delhi	Shri M. K. Mallick Shri Divakar Agrawal (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Shri S. K. Singh Ms M. Surya (*Alternate*)
CSIR–Structural Engineering Research Centre, Chennai	Shri P. Srinivasan Dr B. H. Bharatkumar (*Alternate*)
Delhi Development Authority, New Delhi	Representative
Directorate General of Factory Advise Services and Labour Institute, Mumbai	Shri H. M. Bhandari Shri Amit Gola (*Alternate*)
Engineers India Limited, New Delhi	Shri Anurag Sinha Shri Vikram K. Gupta (*Alternate* I) Shri Immanuel G. Fernandez (*Alternate* II)
Everest Industries Limited, Noida	Shri Y. Srinivasa Rao Shri Jawahar I. Rawtani (*Alternate*)
Gammon Engineers and Contractors Private Limited, Mumbai	Shri Anirwan Sengupta Shri Anant Kadiwal (*Alternate*)
Housing and Urban Development Corporation Limited, New Delhi	Shri N. L. Manjoka Shri Akhilesh Kumar (*Alternate*)
HIL Limited, Hyderabad	Shri R. Pradeep Kumar Dr D. Satyanarayana (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Prof R. Ayothiraman
Indian Institute of Technology Bombay, Mumbai	Representative
JSW cement limited, Mumbai	Shrimati Lopamudra Sengupta Shri Hari Prasad Rao (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	Col Sumeet Singh Makkar Lt Col K. V. Vinayaka (*Alternate*)
Ministry of Science and Technology, Dept of S & T, New Delhi	Representative

Organization	*Representative(s)*
Ministry of Environment, Forests and Climate Change, New Delhi	Representative
National Council for Cement and Building Materials, Ballabgarh	Shri P. N. Ojha Dr Varsha Liju (*Alternate* I) Shri Lalit Yadav (*Alternate* II)
National Test House, Kolkata	Shri B. R. Meena Shri Aloke De (*Alternate*)
North Delhi Municipal Corporation, New Delhi	Shri Pradeep Bansal Shri M. P. Gupta (*Alternate*)
Public Works Department, Govt of Haryana, Chandigarh	Shri Lalit Arora
Rural Electrification Corporation Limited, New Delhi	Shri G. S. Bhati Shri Ranjit Ranjan (*Alternate*)
Saint-Gobain India Private Limited, Chennai	Shrimati Harinee Shrimati Santhanan (*Alternate*)
Spun Pipes Manufacturer’s Association of Maharashtra, Nanded	Shri C. Y. Gavhane Shri D. N. Joshi (*Alternate*)
Tamil Nadu Water Supply and Drainage Board, Chennai	Shri S. Hariramasamy
The Fibre Cement Products Manufacturers Association, New Delhi	Shri Durgesh C. Sharma
The Indian Hume Pipe Company Limited, Mumbai	Shri P. R. Bhat Shri S. J. Shah (*Alternate*)
In Personal Capacity (*B-806, Oberoi Exquisite Oberoi Garden City, Goregaon East*), Mumbai	Shri A. K. Jain
BIS Directorate General	Shri Sanjay Pant, Scientist ‘F’ and Head (Civil Engineering) [Representing Director General (*Ex-officio*)]

Member Sectary

Dr Manoj Kumar Rajak
Scientist ‘D’ (Civil Engineering), BIS

and

Shri Sinam Hudson Singh
Scientist ‘D’ (Civil Engineering), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: CED 53 (16891).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : 601/A, Konnectus Tower-1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002 — 2323 7617

Eastern : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091 — 2367 0012, 2320 9474

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg Chandigarh 160019 — 265 9930

Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113 — 2254 1442, 2254 1216

Western : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093 — 2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi